CHIEF JAY FLEMING'S COMMENTS ON THE IAFC'S SMOKE ALARM POSITION PAPER
(JAY'S COMMENTS WILL BE IN BOLD ITALICS.)

International Association of Fire Chief's Position Paper

Smoke Alarms - Ionization and Photoelectric Technology

Summary - The Fire and Life Safety Section (FLSS) of the International Association of Fire Chiefs (IAFC) is providing this summary of current information regarding the use of ionization and photoelectric smoke alarms for its members to use in their public education programs. The goal is to explain the different response characteristics of these two types of smoke alarms and offer advice relating to what to tell the public about smoke alarm use. It is important to note that smoke alarms are only one component of a comprehensive residential fire protection plan that also includes the installation of residential fire sprinklers and fire escape planning. For the best protection, all smoke alarms should be interconnected throughout the home.

Jay Fleming's Comments

Although this Position paper contains a lot of good information it also, in my opinion, contains incomplete information. In addition, most of the errors have the net result of favoring the ion smoke alarms relative to the photoelectric. (This is probably due to the fact that the documents relied upon have these characteristics.) I will make comments on some sections of this paper. If I think a statement or section hides the benefit of photoelectric technology or hides the problem of ionization technology, I will note that with a "star."

In April 2007, Underwriters Laboratories (UL) and the NFPA Fire Protection Research Foundation (FPRF) published a report of the UL Smoke Characterization Project which stated that residential smoke alarms provide a critically important notification to occupants that there is a presence of smoke and/or fire.

Jay Fleming's Comments

According to a May 2005 UL Press Release, this study was undertaken due to research presented at the April 205 UL Fire Council. This research, referred to in the Press Release, was presented by me. I showed that ionization smoke detectors that passed the UL217 test were operating to late in real fires. I also outlined my concern that the UL217 smoldering test did not adequately test for smoke from synthetic materials. I will forward a copy of the press release and my presentation to the IAFC.

The study by UL reported that fires in either a flaming or a smoldering phase provide several cues for smoke alarms, including:

- smoke particulates
- heat
- gasses such as carbon monoxide, also known as CO.

The study explained that current smoke alarms use two types of smoke sensing technologies: photoelectric or ionization. The photoelectric type has a light source and detects the scattering or obscuration caused by smoke particulates. The ionization type detects changes in local ionization field within the detection chamber resulting from the presence of smoke. Both types of alarms activate when a set threshold is reached.

Jay Fleming's Comment

What does the phrase "Both types of alarms activate when a set threshold is reached," mean? What is the set threshold? In many of the smoldering synthetic fires the ion detectors never responded so what threshold are they talking about? This statement implies some type of equivalency that does not exists.

The Study did discuss the issues that the IAFC mentions but it did much more. Here are some of the "Future Considerations" outlined in the report.

1. Add a synthetic material test in the flaming and non-flaming mode.

(I first suggested this in my 1998 paper. In addition, the "smoke profile," obtained in the results for smoldering synthetic material fires, is just as I predicted it would be in my 2005 presentation at the UL Fire Council.)

2. Whether a smoke alarm once triggered, should remain activated unless deactivated manually. (This was based on the observation that over time the smoke would stratify below the ceiling.)

(This is a stupid and dangerous "consideration." The smoke only stratified in these test because such a small amount of material was used. As a consequence, smoke stopped being produced after a while and some dropped below the ceiling due to gravity. This never happens in real fires. This suggestion would greatly increase the disablement of detectors with no benefit at all.

3. Requiring the use of combination of ion and photo alarms for residential use in order to maximize responsiveness to a broad range of fires. The rationale for this was that some of the flaming tests did not trigger the photo alarm and some of the smoldering tests did not trigger the ion alarm.

(In the smoldering UL fires during which the ion did not respond the ion detector behaved similarly to the ions in the NIST Tests. In the NIST Tests, the ion detectors do not respond to smoldering synthetic smoke until 15-25% obscuration per foot. This amount of smoke is far higher than the UL passing criteria of 10%. It is also higher than the commonly accepted tenability limit of 15%.

In the flaming UL fires that the photo did not respond, the reason that it did not is because almost no smoke was produced. In none of the 3 flaming fires were the photo did not respond did the % obscuration exceed 5% obs/ft. It hardly seems logical to recommend combination detectors because the photo will only respond if there is a noticeable amount of smoke. If a fire produces almost no smoke it will never become a hazard so who cares if the alarm does not respond.)

Finally the Smoke Characterization Reports neglect to mention that the "smoke profile" obtained for smoldering synthetic material is very different from the existing UL17 Smoke profile, which was based on cotton mattresses. This explains why the ion detectors, that pass the UL217 Test, are responding too late in the NIST Tests. This result, which is clearly the most important finding, is not mentioned at all. (In addition, the main point of my presentation to the UL Fire Council was a hypothesis that this was the case. Since it was the basis for the report being done in the first place, why was evidence supporting my hypothesis ignored?

A copy of UL's study may be found at:
http://www.nfpa.org/assets/files/PDF/research/SmokeCharacterization.pdf

The UL Smoke Characterization Project followed a 2004 study conducted by the National Institute of Standards and Technology (NIST) that indicated fires in today's homes smolder longer and then burn hotter and faster than what was typical when smoke alarms were first introduced a number of years ago.

Jay Fleming's Comment

The UL Study did not "follow the 2004 NIST Study." This statement implies that it was a follow-up to the NIST Study. However, there is nothing in the NIST Study which mentions the need for this kind of study. The truth is, according to a May 2005 UL Press Release, that this UL Study "followed" a presentation I gave to the 2005 UL Fire Council highlighting the flaws in the conclusions of the 2004 NIST Study, including the failure to call for this kind of study.

The NIST study also concluded that because fires could be more aggressive, the time needed to escape some types of fires has been reduced significantly from approximately seventeen (y) minutes, at the time of the original study in the 1970s, to as little as three (3) minutes under certain conditions today.

Jay Fleming's Comment

As I have pointed out to NIST previously this statement is seriously flawed for the following reasons.

1) ***The NIST report, which the IAFC relies upon, fails to point out that this estimate only applies to "flaming fires" and that according to NIST, "Average time to untenable conditions for smoldering fires was comparable to those observed in the 1975 tests." WHY IS THIS FINDING IGNORED?***
2) ***The 17 minute estimate from the mid 70's study is incorrect. In most of these flaming scenarios from the mid 70's tests, it took several minutes for the furniture to ignite. My analysis of these flaming scenarios indicates that a more accurate estimate for the mid 70's fires, involving natural materials, would be 7-10 minutes. The average time to untenability for the flaming fires in the 2004 Tests was approximately 3 ½ minutes. So it appears a 2-3 fold decrease occurred, not a 6 fold decrease as implies by NIST. Think about it, if fires actually took 17 minutes to reach untenability why did so many people die in fires in the 70's? THE 17 MINUTE ESTIMATE NEVER MADE ANY SENSE.***

3) ***The key reason why the flaming fires in the 2004 test grew faster is because they used synthetic furniture. As I pointed out in my 1998 paper on the topic, the mid 70's NIST Study used furniture made with natural materials. This is significant to point out because the fact that synthetic material produces faster flaming fires, which the NIST 2004 Report & the IAFC treats as "new" information has been identified by researchers, including NIST since at least the mid 80's. here are just a few examples.***

- ***Grand et al, "An Evaluation of Toxic Hazards from Full Scale Furnished room Fire Studies" (Southwest Research Institute, 1985)***
  - ***Ignition to untenability in room of origin (1 minute), ignition to untenability in remote room (4.5 minutes) – NFPA Handbook 17th Ed.***
- ***Lawson & Quiniere, "Slide Rule Estimates of Fire Growth" (National Bureau of Standards, 1986) – NFPA's Fire Technology, February 1986.***
  - ***Visibility of 1 m in corridor (175 secs) Smoke filling of corridor (181 secs).***
- ***Levine & Nelson, "Full Scale Simulation of a Fatal Fire," (National Institute of Standards, 1990)***
  - ***Flashover of kitchen fire 3 minutes after "sustained burning." Occupants trapped between 3- 4 minutes after "sustained burning."***

Fires, in the flaming mode, are not necessarily growing faster than they were in the mid 70's. Flaming fires involving synthetic materials, as opposed to natural materials, grow faster and this was true in the mid 70's as well as today.

While current technology smoke alarms were found in the NIST study to operate within the established performance criteria, there was a difference in activation times for the different sensing technologies (photoelectric or ionization) depending upon the type of fire development (fast-flaming fires verses smoldering fires).

Jay <u>Fleming's Comment</u>

Why is it important to mention that, "current technology smoke alarms were found in the NIST study to operate within the established performance criteria"? This statement implies "equivalency" between the detectors. What is not mentioned is that the recent UL "Smoke Characterization Report has produced data that confirms my hypothesis mentioned in my papers of 1998 and 2005 that the "established performance criteria" is inadequate for smoldering synthetic material. In fact, in the NIST Home Smoke Alarm Report the ion detectors are responding at smoke obscuration levels that are twice the "established performance criteria" in UL217.

The link to published work on the NIST website is: http://smokealarm.nist.gov/

Early detection and notification of fires is critical to escape time, because the time to arrive at untenable conditions in residences can be as little as three minutes for typical flaming fire scenarios. Both ionization and photoelectric smoke alarm technologies quickly alert occupants in most fire scenarios.

<u>Jay Fleming's Comment</u>

In most flaming scenarios the occupant is awake so why is early detection by the smoke alarm important? Here is a quote from one researcher. "It is recognized that

deadly fires and fires doing the most damage typically have a substantial undetected incipient stage while flame-ignited fires are typically intimate with awake people and connected to their activities. Hence, detection in order to alert is less important (in flaming fires). Reference - Building Fire Statistics 88-97 Norway. Directorate for Fire and Explosion Prevention.

In the controlled experiments conducted by NIST, ionization alarms react earlier than photoelectric alarms in fast-flaming fires, such as those involving paper or flammable liquids, while photoelectric alarms tend to react substantially earlier than ionization alarms in smoldering fires, such as those ignited by cigarettes in upholstered furniture, bedding materials, and mattresses.

Jay Fleming's Comment

How can the IAFC claim that both technologies "quickly alert occupants?" What study is this claim based upon? I would like to quote from NIST's testimony to the Boston City Council. (This testimony is available at http://smokealarm.nist.gov/)

> ***"Properly installed and maintained ionization and photoelectric alarms provide enough time to save lives for most of the population under many fire scenarios."***

Now compare this to the following from the NIST Press Release issue in 02/26/2004.

> ***"According to the two-year NIST home smoke alarm performance study, ionization smoke alarms respond faster to flaming fires, while photoelectric smoke alarms respond quicker to smoldering fires. The report concluded that, despite these differences, the placement of either alarm type on every level of the house provided the necessary escape time for the different types of fires examined.***

Unlike the original Press Release, NIST now places limits on the ability of smoke alarms to provide the necessary escape time. Now it only happens for most people for many scenarios not all people for all scenarios.

Here is another quote from NIST's testimony to the Boston City Council.

> ***"Ionization detectors have been shown to sometimes fail to alarm even when visibility in the room of origin is significantly degraded by smoke. Most photoelectric detectors alarm substantially sooner in these situations. In the NIST experiments the photoelectric detectors sensed smoldering fires on average 30 minutes earlier than ionization detectors. The same study demonstrated that ionization detectors respond, on average 50 seconds earlier than photoelectric during flaming fires."***

This analysis seems to be based, not upon data found in the NIST Report, but on data found in NIST's response to my critique placed on the NIST Website in March of 2007.

From Table 2 of NIST's Response to Jay Fleming's Questions (03/09/2007)

	Time to 1st Alarm		Available Safe Egress Time(s)	
	Photo	Ion	Photo	Ion
Smoldering	2219 +/- 1061	4010 +/- 1120	2064 +/-950	197 +/- 336
Flaming	97 +/- 31	47 +/- 35	124 +/- 64	175 +/- 70

How can the IAFC claim that ion detectors "quickly alert occupants" to smoldering fires when it is on average responding 65 minutes after ignition and 30 minutes after the photo responds? In addition, it appears that the ion responds too late in approximately 1/3 of the cases. (197 – 336 = -139, which is 1 standard deviation from average.) Keep in mind that for living room fires, NIST measured untenability in the remote bedroom for the mobile home tests and on the 2nd floor for the 2-story home tests. So these results should be considered a best case scenario.

In the flaming fires the ionization is quicker but in most scenarios the photo is providing at least 60 seconds warning and unlike the case of the ion in smoldering fires is always providing a positive ASET. In addition, as mentioned earlier, some researchers have noted, automatic detection is less important in flaming fires since the occupants are usually alert.

> ***"It is recognized that deadly fires and fires doing the most damage typically have a substantial undetected incipient stage while flame-ignited fires are typically intimate with awake people and connected to their activities. Hence, detection in order to alert is less important (in flaming fires). Reference - Building Fire Statistics 88-97 Norway. Directorate for Fire and Explosion Prevention. From "Application Specific Sensitivity: A Simple Engineering Model to Predict response of Installed Smoke Detectors (Jensen G. et al., Interconsult Group ASA paper at Aube 1999).***
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> ***" The advantage of ionization smoke detectors during flaming fires is only about a 15-20 second earlier warning. This margin will only be decisive for the loss of human life in extraordinary circumstances. In general the difference between the alarm times for the optical and the ionization detectors are reduced when the detection is made from an adjacent room. This can be related to the fact that particles in the smoke tend to coagulate (smoke aging)." (Meland, Oysten, and Lonuik, Lars, "Detection of Smoke - Full Scale Tests with Flaming and Smouldering Fires, "Fire Safety Science," - Proceedings of the Third International Symposium, July, 1991,)***
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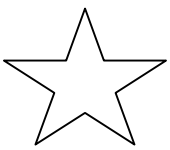
> ***"Smoke detectors should be able to save at least 60% and possibly 75% of sleeping victims, but only 13% of victims who were awake. (McGuire and Ruscoe, 12/62.) (This is because most fatal flaming fires occur while people awake. All fatal smoldering fires occur while victim sleeping. My comment.)***

While it is generally recognized that each sensing technology may be better in particular applications, it is impossible to predict what type of fire will occur in a typical residence. Therefore, fire safety experts recommend that a home have a combination of both ionization and photoelectric smoke alarms or dual sensor smoke alarms that incorporate both type of sensing technologies in one unit to ensure the fastest response to both flaming and smoldering fires. It is vitally important to note that smoke alarms are only



effective when they work. Smoke alarms should never be disabled, and must be tested, cleaned, maintained and replaced according to manufacturers' instructions.

The IAFC, through its Fire & Life Safety Section (FLSS), recommends that IAFC members include the following information when they educate the public about the use of smoke alarms:

- There are two main types of technologies used in smoke alarms to detect smoke. Both technologies detect all types of growing fires. Ionization alarms, which sell for about $5 for battery-operated models, respond faster to flaming fires, such as those involving paper or flammable liquids. Photoelectric alarms, which sell for about $20, respond faster to smoldering fires, such as those ignited by cigarettes in upholstered furniture, bedding materials, and mattresses. Dual sensor smoke alarms use both ionization and photoelectric sensors and cost about $30.

Jay Fleming's Comments

I do not think the IAFC cost estimates are accurate. They seem to favor the ion detector relative to the photo.

- ***First, the IAFC seems to overestimate the cost of the battery powered photo.***
- ***Second, the IAFC fails to take into account that most ions need a "silence" button to comply with NFPA 72. Which raise the cost.***
- ***Third, the IAFC fails to take into account that in many case they smoke alarms will be hard-wired. In these cases there seems to be a smaller differential in cost and most of the total cost of the installation will be labor and wiring.***
- ***Fourth, the BFD buys photoelectrics for $8.25. Clearly much of the cost differential is due to marketing decisions by the manufacturers and retailers as opposed to production differences.***

Here are the results I got from surveying: Home Depot, Sears, Lowes, & Amazon.

		Ionization	*Photoelectric*	*Combination*
IAFC Estimates	***Battery Powered***	***$5***	***$20***	***$30***
Jay Fleming's Estimates	***Battery Powered***	***$5 - $7***	***$13 - $16***	***$21 - $25***
	Battery with "Silence" Button	***$10 - $13***	***N/A***	
	Hard-wired with battery back-up	***$12 - $17***	***$25 - $27***	***$30 - $40***
BFD Bids*	***Battery Powered***	***$5.75***	***$8.25***	

* ***The Boston Fire Dept. only uses photoelectric detectors in the BFD Smoke Alarm program. These are the competitive bid prices that the BFD received from vendors, (the Photoelectrics cost only $8.25.).***

- Smoke alarms that use either type of sensing technology have been proven to save lives, prevent injuries, and minimize property damage by detecting and alerting residents to fires early in their development, and that the risk of dying from fires in a

home without smoke alarms is twice as high as in homes that have working smoke alarms.

Jay Fleming's Comments

This statement makes both types of technologies seem equivalent. But it is no more accurate to claim that because both ion and photo are better than nothing that they are similar any more than it would be to say that lap belts and air bags provide similar benefits because, "cars that just use lap belts and cars that use lap belts, shoulder belts and air bags have been proven to save lives & prevent injuries,

Given that 90% or more of all smoke alarms are ionization (according to the CPSC) then any statistics regarding alarms would apply to ion alarms. I would like to point out the following.

- ***The NFPA used to say that having a smoke alarm reduced your risk by 50%. Now they say that having an "operating" smoke alarm reduces your risk by 50%. (NFPA 2007 Smoke Alarm Report) Have smoke alarms become less effective over time? The same report has data which indicates the reduction in risk in apartments is only 33%. Of course, since in most apartments the occupants have to escape through the living room one would not expect smoke alarms to be that effective based on the results from the NIST Report.***
- ***Some of this reduction in risk must be due to socioeconomic factors that accompany smoke alarm ownership: newer homes, higher income, more metropolitan, more educated etc.***
- ***According to some of the early smoke alarm studies, Smoke Alarms were supposed to reduce fire deaths by 50%-65% all by themselves. Yet according to the 207 NFPA report they can take credit for only about 1/3 of the 3,000 less deaths per year since the late 70's, even though over 90% have smoke alarms and most are operational.***
- ***Smoke alarms, i.e. ionization smoke alarms, have reduced fire fatalities but not nearly as much as was anticipated.***
- ***Since 1990, the % of fire fatalities with operating smoke alarms has doubled. This increase has coincided with the gradual introduction of UL mandated "less sensitive" ion detectors. (UL also modified the smoldering test in the late 80's. In my opinion, this change was made to accommodate these less sensitive ion detectors.)***

❖ Since it cannot be predicted what type of fire will start in a home, it is important that both smoldering and flaming fires are detected as quickly as possible. The best protection is to have both types of smoke alarms installed, or install dual sensing technology smoke alarms that incorporate both ionization/ photoelectric sensors.

Jay Fleming's Comments

In my opinion, this is a very misleading statement. Although it is impossible to predict what type of fire will occur, it is possible to predict the most likely fire to occur while people are sleeping, which is when the smoke alarm can make a

difference. This of course is the "smoldering started" fire. Other researchers agree.

- ***Delayed discovery, typically associated with fires that occur at night when everyone is asleep, also tends to be a characteristic of the smoldering fire caused by discarded smoking material. These smoldering fires are the leading causes of US fire fatalities and detectors are ideally designed to deal with them. "A Decade of Detectors", Fire Journal 09/85, John Hall.***

❖ Working smoke alarms should be installed on every level of the home, outside sleeping areas and inside bedrooms, as per manufacturer's specifications. Furthermore, smoke alarms can only offer protection if they are working, and as such, they should be tested, and maintained in accordance with the manufacturer's specifications.

❖ If smoke alarms are battery operated or have battery back-up, the batteries should be replaced at least once a year during the IAFC's "Change your clock, change your battery" program in October. In addition, experts say that the entire smoke alarm itself should be replaced every l0 years.

❖ Batteries should never be removed to disable a smoke alarm, even if you experience "nuisance" alarms, such as while cooking or showering. Simply fan the detector with a newspaper or towel to stop the alarm. Clean the smoke alarm according to the manufacturer's instructions, and consider relocating it away from the kitchen or bathroom. Some smoke alarms have a silencing or "hush" feature, so nuisance alarms can be stopped quickly and easily. Other smoke alarms use a long-life sealed battery unit so the battery cannot be removed.

<u>Jay Fleming's Comments</u>

Since approximately 20% of all smoke alarms are not working and 20% of all fatalities occur in homes with non-working alarms this is a huge issue. When discussing nuisance alarms the IAFC highlights the benefit of "silencing" buttons (usually installed on some ion alarms). <u>However, I am not aware of any study or research that has ever proven this technology to actually reduce disablement of detectors</u>. At the same time the IAFC recognizes an unproven technology, they neglect to mention the benefit of using photoelectric technology as opposed to ionization technology. This benefit has been noted by several researchers. The IAFC's position which is implicitly encouraging the use of ion technology is not supported by the available research.

Here are some recent quotes by researchers on nuisance alarms.

> ***"<u>Homes with ionization alarms had more than 8 times the rate of false alarms as those with photoelectric. In small rural residences, photoelectric smoke alarms have lower rates of false alarms and disconnections</u>."- M. Perkins – Alaska Injury Prevention Center (published in the WJM 08/2000)***
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> ***"A recent study conducted among rural Iowa homes examined the relation between smoke alarm types and alarm functionality at 12 months after installation. We focused on rural homes because fire death rates are highest in rural***

populations and little residential fire safety research has been conducted in rural settings. <u>We found that ionizing smoke alarms had nearly 2 ½ times the reported rate of false alarms when compared with photoelectric alarms</u>." (Quote from an e-mail sent to me regarding a forthcoming study to be published in late 2007.)
-Corinne Peek-Asa, PhD - Director, Injury Prevention Research Center
Professor, U of Iowa Department of Occupational and Environmental Health

"Most field data suggests that ionization alarms have a greater propensity for nuisance alarms than photoelectric smoke alarms." (NIST Response to J. Fleming's Questions, March 2007)

"It was observed that ionization alarms had a propensity to alarm when exposed to nuisance aerosols produced in the early stages of some cooking activities, prior to noticeable smoke production. This phenomenon could be particularly vexing to homeowners who experience such nuisance alarms." (Executive Summary of NIST Home Smoke Alarm Report – 2004)

"Most nuisance alarms from cooking involve smoke alarms with ionization-type sensors (see smoke alarm facts and questions). That is because this type of sensor is sensitive to very small smoke particles, even particles that are invisible to the naked eye. The high heat from cooking generates small, "invisible" smoke particles." (Operation Life Safety, www.**firesafehome.org)**

Even the NFPA 72 Standard recognizes the benefit of photoelectric technology to reduce nuisance alarms. Why doesn't the IAFC?

- Studies have shown that some children may not awaken from the sound of a smoke alarm for a variety of reasons. Parents and care providers should conduct a fire drill when their children are sleeping so they can assess their children's ability to awaken and respond appropriately. If children, or any other family members, do not awaken or do not react appropriately to the smoke alarm, the home escape plan should be modified accordingly to ensure that all family members are able to get out safely. The IAFC is aware of certain types of alarms that project a recording of the parents' voice or some other sound to which children may be more responsive than the traditional alarm.

- For elderly people, those who have impaired hearing or those who have other disabilities that make the alarm difficult to hear, there are smoke alarms that use strobe lights and vibrators in addition to sound. Exploring alternative approaches such as these may make sense in those households.

- Consider the installation of a residential fire sprinkler system. Fire protection involves a complex, multi-faceted approach that does not rely upon any one measure for safety.

- The National Fire Protection Association (NFPA) reports that the provision of both smoke alarms and residential fire sprinklers increases survivability of a fire in a home by 82% over having neither.

- Develop and regularly rehearse an escape plan with all members of your household, so that when the smoke alarm sounds, everyone will move to a safe location outside the home. For information on how to develop a home escape plan, see http://www.nfpa.org/assets/files/PDF/FPWgris03.pdf

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The IAFC and the FLSS is grateful to Underwriters Laboratories, The NFPA Fire Protection Research Foundation, NFPA, and the National Association of State Fire Marshals for their contributions to this document, and hopes that the membership of the IAFC find this information useful when offering advice about smoke alarms to the public we so proudly serve.

Approved by IAFC Board, August 21, 2007

Jay Fleming's Comments

I would ask that the IAFC review my comments as well as the research papers that I will attach. I think that an objective analysis of my research will lead the committee to agree with the conclusions of the Australasian Fire Authorities Council. In 2006 they issued a similar position paper regarding smoke alarms. The final recommendation was based to a certain extent on the same research and logic that I have presented in my comments to the IAFC. I will forward the full position to the IAFC as well as a letter that was sent to the Commissioner of the BFD regarding the basis for their opinion. (This has also been adopted by Tasmanian Fire Officials.)

From the AFAC's Position on Smoke Alarms in Residential Accommodation – June 1, 2006

3. Type

- ***That all residential accommodation be fitted with photo-electric smoke alarms.***

Note 1: There are two principle types of smoke alarms, ionisation and photo-electric smoke alarms. Ionisation smoke alarms predominantly detect the presence of extremely small particles of smoke whilst photo-electric smoke alarms predominantly detect visible smoke.

Note 2: Some research indicates that both ionisation and photo-electric smoke alarms provide occupants time to escape. AFAC's position however is based on current knowledge about smoke alarm performance; that is that photo-electric alarms are generally more effective than ionisation alarms across the broader range of fire experienced in homes, and should be promoted as the technology of choice.

Note 3: Current research indicates that:

- ***ionisation smoke alarms detect flaming fires marginally earlier than photo-electric smoke alarms.***

- ***photo-electric smoke alarms detect smouldering fires and fires starting in areas remote from smoke alarms significantly earlier than ionisation smoke alarms.***

- ***ionisation smoke alarms may not operate in time to alert occupants early enough to escape from smouldering fires.***

- ***for both flaming fires and smouldering fires, photo-electric smoke alarms are likely to alert occupants in time to escape safely.***

Note 4: As many fires in residential accommodation begin as smouldering fires, photoelectric smoke alarms provide more effective all-round detection and alarm than ionisation alarms.

Note 5: Householders may choose to maintain ionisation smoke alarms until the end of their service life. However, householders should also install photo-electric smoke alarms in accordance with the locations described below.

Note 6: Smoke alarms fitted with dual photo-electric l ionisation detectors are available. Householders may choose to install such alarms in lieu of photo-electric alarms. However, research indicates that they are more costly and prone to more false alarms than photo-electric alarms, and the benefits are marginal.

Jay Fleming's Comment

I agree with the AFAC's position. (I originally put forth this logic in my 1998 paper.) An analysis of Massachusetts Fire Fatalities over a three year period (2003 – 2005) clearly indicates that the % of fatalities occurring with non-working detectors (16 or 23% of the fires were the alarm status is "known)," far exceeds the number of fire victims who died in flaming fires while they were sleeping (possibly 1 or at most 3). As a consequence, a policy that encourages combination detectors, without accounting for the potential for nuisance alarms, will probably prove less beneficial than a policy that encourages photoelectric with the option for combination where appropriate.

Summary

Finally, I would like to point out that both the UL Smoke Characterization Report as well as the NIST Home Smoke Alarm Report might not have even been done if it wasn't for my research in this area. In addition, NIST has re-evaluated their results because of my analysis of their original report. I am only asking that the IAFC take my research as seriously as the CPSC, UL, NIST & the AFAC have.

Nothing in this position paper or the research that it relies upon appears to have any evidence or logic that would change my recommendation to the Fire

Commissioner of the BFD that our policy on smoke alarms should be the following:

1. ***That the greatest benefit is achieved by installing photoelectric alarms, as a minimum, with the option of installing combination in areas not susceptible to nuisance alarms.***
2. ***That providing photoelectric alarms in the BFD give-away program is the method that provided the highest likelihood of achieving adequate response while minimizing disablement.***

In the past, I have not asked for a written response from the IAFC in response to the materials I have sent to the IAFC. In this case, I would appreciate a response to the concerns outlined in this letter. Hundreds of lives are at stake.

I am not sending all of my research since it is too lengthy. I will send any material in my possession that is requested by the committee or answer any questions that may occur to any member of the committee. I appreciate the opportunity to bring this information to the committee.

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